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ABSTRACT

The United States Training and Employment Service General Aptitude Test Battery (GATB), first published in 1947, has been included in a continuing program of research to validate the tests against success in many different occupations. The GATB consists of 12 tests which measure nine aptitudes: General Learning Ability; Verbal Aptitude; Numerical Aptitude; Spatial Aptitude; Form Perception; Clerical Perception; Motor Coordination; Finger Dexterity; and Manual Dexterity. The aptitude scores are standard scores with 100 as the average for the general working population, and a standard deviation of 20. Occupational norms are established in terms of minimum qualifying scores for each of the significant aptitude measures which, when combined, predict job performance. Cutting scores are set only for those aptitudes which aid in predicting the performance of the job duties of the experimental sample. The GATB norms described are appropriate only for jobs with content similar to that shown in the job description presented in this report. A description of the validation sample and a personnel evaluation form are also included. (AG)

June 1969 United States Training and Employment Service Technical Report S-438

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Development of USTES Aptitude Test Battery

for

Forester Aid

(gov. ser.) 441.384

TM 002 050

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Technical Report on Development of USTES Aptitude Test Battery

For.....

FORESTER AID (gov. ser.) 441.384

S-438

(Developed in Cooperation with the
Oregon State Employment Service)

U. S. Department of Labor
Manpower Administration

June 1969

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FOREWORD

The United States Training and Employment Service General Aptitude Test Battery (GATB) was first published in 1947. Since that time the GATB has been included in a continuing program of research to validate the tests against success in many different occupations. Because of its extensive research base the GATB has come to be recognized as the best validated multiple aptitude test battery in existance for use in vocational guidance.

The GATB consists of 12 tests which measure 9 aptitudes: General Learning Ability, Verbal Aptitude, Numerical Aptitude, Spatial Aptitude, Form Perception, Clerical Perception, Motor Coordination, Finger Dexterity, and Manual Dexterity. The aptitude scores are standard scores with 100 as the average for the general working population, with a standard deviation of 20.

Occupational norms are established in terms of minimum qualifying scores for each of the significant aptitude measures which, in combination, predict job performance. For any given occupation, cutting scores are set only for those aptitudes which contribute to the prediction of performance of the job duties of the experimental sample. It is important to recognize that another job might have the same job title but the job content might not be similar. The GATB norms described in this report are appropriate for use only for jobs with content similar to that shown in the job description included in this report.

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GATB Study # 2751

DEVELOPMENT OF USTES APTITUDE TEST BATTERY

FOR

Forester Aid (gov. ser.) 441.384-010

S-438

This report describes research undertaken for the purpose of developing General Aptitude Test Battery (GATB) norms for the occupation of Forester Aid 441.384-010. The following norms were established:

GATB Aptitudes	Minimum Acceptable GATB, Scores
V-Verbal Aptitude	90
N-Numerical Aptitude	95
K-Motor Coordination	90
M-Manual Dexterity	90

Research Summary

Sample

78 male trainees who completed a 37-week training course for Forester Aid at various community colleges in Oregon comprised the final sample. The testing for this study was conducted before information concerning minority group status was required. Therefore, minority group composition of this sample is unknown.

Criterion

Instructors' ratings.

Design

Longitudinal (test data were collected either prior to start of training or during the training and criterion data were collected on completion of the course).

Minimum aptitude requirements were determined on the basis of a job and course of study analysis and statistical analyses of aptitude mean scores, standard deviations, aptitude-criterion correlations, and selective efficiencies.

Predictive Validity

Phi Coefficient = .42 ($P/2 < .0005$)

Effectiveness of Norms

Only 68% of the non-test-selected trainees used for this study were

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good trainees; if the trainees had been test-selected with the above norms, 83% would have been good trainees. 32% of the trainees used for this study were poor trainees; if the trainees had been test-selected with the above norms, only 17% would have been poor trainees. The effectiveness of the norms is shown graphically in Table 1.

Table 1

Effectiveness of Norms

	Without Tests	With Tests
Good Trainees	68%	83%
Poor Trainees	32%	17%

SAMPLE DESCRIPTION

Size: N = 78

Occupational Status: MDTA trainees

Work Setting: Trainees were enrolled in a 37-week Forester Aid course at Lane Community College, Eugene, Oregon; Central Oregon Community College, Bend, Oregon; Southwestern Oregon Community College, North Bend, Oregon; Salem Technical-Vocational Community College, Salem, Oregon.

Selection Requirements:

Education: High school, but not necessarily graduation.

Previous Experience: No requirement.

Tests: None used.

Other: Personal interview.

Principal Activities: As outlined in job description and course of study in the appendix.

Minimum Experience: All 78 trainees in the sample received the full 37-weeks of training.

Discussion: The final sample consisted of 78 trainees. Nineteen others who were tested were eliminated from the sample: 17 because they did not finish the training and 2 because of physical handicaps which invalidated their test scores.

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TABLE 2

Means, Standard Deviations (SD), Ranges, and Pearson Product Moment Correlation with the Criterion (r) for Age and Education.

	Mean	SD	Range	r
Age (in years)	23.3	5.7	18-47	.164
Education (in years)	12.2	0.5	12-14	.004

EXPERIMENTAL TEST BATTERY

All 12 tests of the GATB, B-1002, were administered to the sample during the period September 1964 through June 1966.

Criterion

The criterion data consisted of instructors' ratings of course proficiency made upon completion of the course of study.

Rating Scale: USTES Form SP-21, "Descriptive Rating Scale for Rating Trainees" (see Appendix).

Reliability: The instructors' ratings were checked for internal consistency by computing a biserial correlation of the sum of items A-G on the rating form with a dichotomy being based upon item H of the rating scale (r_{bis} = .969). The biserial correlation was more than twice the size of its standard error which indicates a significant relationship.

Criterion Score Distribution:

Possible range	8-40
Actual range	10-40
Arithmetic mean	26.0
Standard deviation	6.0

Criterion Dichotomy: The criterion distribution was dichotomized into low and high groups by placing 32 percent of the sample in the low group to correspond with the percentage of trainees who were considered unsatisfactory or marginal. Trainees in the high criterion group were designated "good trainees" and those in the low group as "poor trainees". The criterion critical score is 24.

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APTITUDES CONSIDERED FOR INCLUSION IN THE NORMS

Aptitudes were selected for tryout in the norms on the basis of a qualitative analysis of job duties involved and a statistical analysis of test and criterion data. Aptitudes V, S, P, and M did not have significant correlations with the criterion but were considered for inclusion because the qualitative analysis indicated that the aptitudes were important in the training or job duties and the sample had a relatively high mean score and/or low standard deviations for V, S, and P Aptitudes. Tables 3, 4, and 5 show the results of the qualitative and statistical analyses.

TABLE 3

Qualitative Analysis

(Based on the analysis of the course of study and job duties, the aptitudes indicated appear to be important to work and training success.)

Aptitude	Rationale
V - Verbal Aptitude	Necessary to understand written materials, writing reports, and maintaining records.
N - Numerical Aptitude	Uses mathematics in log scaling and surveying.
S - Spatial Aptitude	Necessary in timber cruising, surveying, drafting, and photogrammetry.
P - Form Perception	Needed in drafting, map making, log scaling, and identifying tree species.
M - Manual Dexterity	Necessary in using hand tools in surveying, park maintenance, and tree planting. Because of the necessity of performing the above mentioned duties, Aptitude M is considered critical.

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TABLE 4

Means, Standard Deviations (SD), Ranges and Pearson Product-Moment Correlations with the Criterion (r) for the Aptitudes of the GATB: N = 78.

Aptitudes	Mean	SD	Range	r
G - General Learning Ability	112.7	10.2	89-137	.288*
V - Verbal Aptitude	106.7	11.8	72-129	.099
N - Numerical Aptitude	108.3	11.5	78-146	.383**
S - Spatial Aptitude	116.1	13.1	88-150	.102
P - Form Perception	114.2	16.4	78-144	.115
Q - Clerical Perception	107.1	13.3	78-161	.269*
K - Motor Coordination	103.3	13.2	70-132	.243*
F - Finger Dexterity	99.7	19.4	58-149	.118
M - Manual Dexterity	111.2	21.1	50-156	.095

*Significant at the .05 level.
**Significant at the .01 level.

TABLE 5

Summary of Qualitative and Quantitative Data

Type of Evidence

Job Analysis Data	G	V	N	S	P	Q	K	F	M
Important		X	X	X	X				X*
Irrelevant									
Relatively High Means	X			X	X				
Relatively Low Standard Deviations	X	X	X	X					
Significant r with criterion	X		X			X	X		

Aptitudes to be Considered for Trial Norms	G	V	N	S	P	Q	K		M*

*M - considered of critical importance.

Derivation and Validity of Norms

Final norms were derived on the basis of a comparison of the degree to which trial norms consisting of various combinations of Aptitudes G, V, N, S, P, Q, K, and M at trial cutting scores were able to differentiate between the 68% of the sample considered good trainees and 32% of the sample considered poor trainees. Trial cutting scores at five point intervals approximately one standard deviation below the mean are tried because this will eliminate about one third of the sample with three-aptitude norms. For two-aptitude trial norms,

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minimum cutting scores of slightly more than one standard deviation below the mean will eliminate about 1/3 of the sample; for four-aptitude trial norms, cutting scores of slightly less than one standard deviation below the mean will eliminate about 1/3 of the sample. The Phi Coefficient was used as a basis for comparing trial norms. Norms of V-90, N-95, K-90, and M-90 provided optimum differentiation for the occupation of Forester Aid (gov. ser.) 441.384-010 The validity of these norms is shown in Table 6 and is indicated by a Phi Coefficient of .42 (statistically significant at the .0005 level).

TABLE 6

Predictive Validity of Test Norms V-90, N-95, K-90, & M-90

	Nonqualifying Test Scores	Qualifying Test Scores	Total
Good Workers	10	43	53
Poor Workers	16	9	25
Total	26	52	78

Phi Coefficient (ϕ) .42 Chi Square (X^2_y) 13.6
Significant Level = P/2 $<$ .0005

DETERMINATION OF OCCUPATIONAL APTITUDE PATTERN

The data for this study did not meet the requirements for incorporating the occupation studied into the OAP's included in Section II of the Manual for the General Aptitude Test Battery. The data for this sample will be considered for future groupings in the development of new occupational aptitude patterns.

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APPENDIX

Sample of Required Curriculum Courses

FALL TERM
Starts September 8, 1964 -- Ends December 4, 1964

	Hr/wk	Units	T/hr	Lab	Theo
Communications I	3	3	36		3
Mathematics II	3	3	36		3
Drafting	6	2	72	6	
General Forestry	3	2	36		3
Silvicultural Practices	3	2	36	2	1
Power Tools	6	3	72	4	2
Forest Surveying I	6	3	72	4	2
Totals	30	18	360	16	14

WINTER TERM
Starts December 7, 1964 -- Ends March 12, 1965

	Hr/wk	Units	T/hr	Lab	Theo
Communication II	3	3	36		3
Mathematics	3	3	36		3
Applied Economics	3	3	36		3
Forest Operations	6	3	72	4	2
Forest Mensuration I	6	3	72	4	2
Forest Surveying II	6	3	72	4	2
Recreation Structures	3	1	36	3	
Totals	30	19	360	15	15

SPRING TERM
Starts March 15, 1964 -- Ends June 10, 1965

	Hr/wk	Units	T/hr	Lab	Theo
Report Writing	3	3	36		3
Tree Identification	4	2	48	3	1
Fire Prevention	2	2	24		2
Forest Surveying III	6	3	72	4	2
Forest Engineering	6	3	72	4	2
Forest Mensuration II	6	3	72	4	2
Elements of Supervision	3	3	36		3
Totals	30	19	360	15	15

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RATING TRAINEES

DESCRIPTIVE RATING SCALE

(For Aptitude Test Development Studies)

Score_____

RATING SCALE FOR_____
(DOT Title and Code for Training Course)

Directions: Please read "RATING TRAINEES - SUGGESTIONS TO RATERS" and then complete this rating scale. In making your ratings, only one box should be checked for each question.

Name of trainee (print)_____
(Last) (First)

Sex: Male_____ Female_____

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A. How much aptitude or facility does he have for the vocational training? (Trainee's adeptness or knack for performing the work easily and well.)

- ☐ 1. Has great difficulty doing the work. Not at all suited for the training.
- ☐ 2. Usually has some difficulty doing the work. Not too well suited for the training.
- ☐ 3. Does the work without too much difficulty. Fairly well suited for the training.
- ☐ 4. Usually does the work without difficulty. Well suited for the training.
- ☐ 5. Does the work with great ease. Exceptionally well suited for the training.

B. How much ability does he have for maintaining adequate production in the vocational activity for which he was trained?

- ☐ 1. Capable of very low work output. Can perform only at an unsatisfactory pace.
- ☐ 2. Capable of low work output. Can perform at a slow pace.
- ☐ 3. Capable of fair work output. Can perform at an acceptable but not a fast pace.
- ☐ 4. Capable of high work output. Can perform at a fast pace.
- ☐ 5. Capable of very high work output. Can perform at an unusually fast pace.

C. How good was the quality of his work during the vocational training?

- ☐ 1. Performance was inferior and almost never met minimum quality standards.
- ☐ 2. Performance was usually acceptable but somewhat inferior in quality. The grade of his work could stand improvement.
- ☐ 3. Performance was acceptable but usually not superior in quality.
- ☐ 4. Performance was usually superior in quality.
- ☐ 5. Performance was almost always of the highest quality.

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D. How quickly did he learn the instructional units of the vocational training?

- ☐ 1. Learned the work very slowly. Needed careful and repeated instructions.
- ☐ 2. Learned the work somewhat slower than most.
- ☐ 3. Learned most of the work in the usual amount of time.
- ☐ 4. Learned most of the work quickly.
- ☐ 5. Learned all of the work very rapidly. Needed only the minimum amount of training or instructions for even the difficult aspects.

E. How much ability does he have for using the equipment of the vocational training?

- ☐ 1. Has very limited ability. Cannot use the equipment adequately.
- ☐ 2. Has little ability. Can use the equipment to "get by."
- ☐ 3. Has a moderate amount of ability. Can use the equipment to do fair work.
- ☐ 4. Has high ability. Can use the equipment to do good work.
- ☐ 5. Has very high ability. Can use the equipment to do excellent work.

F. How large a variety of job duties can he perform efficiently?

- ☐ 1. Cannot perform different operations adequately.
- ☐ 2. Can perform a limited number of different operations efficiently.
- ☐ 3. Can perform several different operations with reasonable efficiency.
- ☐ 4. Can perform many different operations efficiently.
- ☐ 5. Can perform an unusually large variety of different operations efficiently.

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G. How resourceful is he in coping with work situations that are different or out of the ordinary?

☐ 1. Almost never is able to figure out what to do. Needs help on even minor problems.

☐ 2. Often has difficulty handling new situations. Needs help on all but simple problems.

☐ 3. Sometimes knows what to do, sometimes doesn't. Can deal with problems that are not too complex.

☐ 4. Usually able to handle new situations. Needs help on only complex problems.

☐ 5. Practically always figures out what to do himself. Rarely needs help, even on complex problems.

H. Considering all the factors already rated, and only these factors, how acceptable was his performance during vocational training?

☐ 1. Performance was unsatisfactory.

☐ 2. Performance was not completely satisfactory.

☐ 3. Performance was satisfactory.

☐ 4. Performance was good.

☐ 5. Performance was outstanding.

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JOB TITLE: FORESTER AID (gov. ser.) 441.384-010

JOB SUMMARY: Works under the immediate supervision of a forestry technician or forester in performing fundamental tasks concerning forest management and rehabilitation. Works in the woods performing such tasks as taking compass bearings, planting trees, and taking routine forest inventories. Work may also be performed for engineering crew in taking land surveys and mapping road and boundary locations. Assists in cruising timber tracts to determine volumes and values. Gathers field data in connection with forest research and forest rehabilitation projects. Assists in surveys of stocking for seeded and planted areas. Transfers and plots information on forest maps from aerial photographs or field sources. Scales logs. Does routine statistical and clerical work in connection with forest inventories and timber sales.

COURSE OUTLINE: The following courses were basic to the curriculums offered in the different Forester Aid programs at Southwestern Oregon Community College, Central Oregon Community College, Salem Technical-Vocational Community College, and Lane Community College.

General Forestry - This course is designed to familiarize the student with forest theory and practice and demonstrate the historical significance of forestry. This course covers the theory and field work in Forest Engineering, Silviculture, Protection, Recreation, and Range Policy.

Drafting - This course is designed to give the student an understanding of drafting techniques and their practical use in forestry.

Tree Identification - This course is designed to help the student gain ability to identify all commerically important and associated species of trees and shrubs native to the Pacific Northwest.

Basic Mathematics - This course is designed to give the student a review of high school mathematics and to introduce the student to the mathematical principles necessary for other course work

Surveying - This course is designed to give the student the practical background for forestry engineering. Practical work experience is provided in the use of surveying instruments and the methods of applying mathematical principles to their use.

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Timber Cruising and Log Scaling and Grading - This course covers the elements of estimating and appraising value of timber. It provides practical work in grading, estimating size, and preparing reports including type, species, grade and size of timber, estimated yield, and topography of area.

COURSE SUMMARY: The Forester Aid curriculum is designed to prepare students to enter the field of forest management or to work as aids to Foresters. The Forester Aid performs a variety of semi-skilled and routine semi-technical work in connection with forest management, rehabilitation, protection, and research programs.

The curriculum is designed to provide some knowledge of the principles, practices, and techniques of forest management and protection, working knowledge of fundamental mathematics, ability to write reports of work and maintain records. Completion of this course makes it possible for the student to enter work as Forester Aid.

Effectiveness of Norms: Only 68% of the non-test-selected trainees used for this study were good trainees; if the trainees had been test-selected with the S-438 norms, 83% would have been good trainees. 32% of the trainees used for this study were poor trainees; if the trainees had been test selected with the S-438 norms, only 17% would have been poor trainees.

Applicability of the S-438 Norms: The aptitude test battery is applicable to jobs which include a majority of the duties as described in the job summary.

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